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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/681,467	04/12/2001	Pierre R. Emeric	GEMS8081.066	7339

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EXAMINER
SHRIVASTAV, BRIJ B

ART UNIT	PAPER NUMBER
2859	

DATE MAILED: 04/28/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	**Application No.** 09/681,467	**Applicant(s)** EMERIC ET AL.
	Examiner Brij B Shrivastav	**Art Unit** 2859

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 April 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) ____ is/are withdrawn from consideration.

5)☐ Claim(s) ____ is/are allowed.

6)☒ Claim(s) *1-30* is/are rejected.

7)☐ Claim(s) ____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *12 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3 .
4) ☐ Interview Summary (PTO-413) Paper No(s). ____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

1. Claims 1-3, 8, 10, 13-16, 21, 22, 24 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nerreter (US 6,525,537), and further in view of Takamori et al (US 6,043,653).

As regards to claim 1, Nerreter teaches a cooling system having a cooling tube assembly with fluid flowing through it to transfer heat from an electrical coil (figure 1, numerals 1, 4), and a heat exchanger where the heat from the coolant is transferred to return the coolant to a desired temperature (figure 1, numerals 6, and 9). Further, Nerreter teaches a control feedback system to the heat exchanger (chiller) to dynamically adjust the coolant temperature (figure 1, numerals 7, 10, 11, and 12). Nerreter does not specifically teach a coolant tube enclosure to adjust the internal dew point less than that of surrounding atmosphere. Takamori et al teach an enclosure with a vacuum pump, which can adjust the internal pressure of the enclosure, thereby adjusting dew point to a value less than the surroundings (figures 1 and 2, column 7 and 8, lines 45-67 and 1-32).

It would have been obvious to one of ordinary skill in the art to adapt Takamori et al's enclosure system with the cooling tube system of Nerreter to keep dew point below

surroundings, thus reducing humidity to avoid heat transfer to the tube surroundings to improve temperature control of the system for commercial uses, such as magnetic resonance imaging.

As regards to claim 2 Nerreter further does not teach a device to remove humidity and maintain enclosure under negative pressure. Takamori et al teach a device; a vacuum pump, to remove humidity and maintain enclosure under negative pressure (figure 1, numeral 56, column 7, lines 53-55). It would have been obvious to one of ordinary skill in the art to incorporate the device of Takamori et al in the cooling system of Nerreter to maintain negative pressure in the enclosure to improve cooling, which in turn will improve image quality.

As regards to claim 3 Nerreter teaches incorporation of the cooling system into an MRI scanner (see abstract).

As regards to claim 8, Nerreter further teaches coolant pump controlling the flow rate in response to the feedback to the control system (figure 1, numerals 6, 8, 12).

2. As regards to claim 10, Nerreter teaches coolant tubes with the coolant passing through them, and in contact with the gradient coil of an MR device with a heat exchanger to remove heat from the coolant (see abstract; figure 1, numerals 1,4, 6). Further, Nerreter teaches temperature sensor and a controller to control the coolant temperature of the MR device (figure 1, numerals 7, 12, see abstract). Nerreter does not teach a vacuum chamber enclosing gradient coil(s) and the coolant tubes of an MR system. Takamori et al teach a vacuum chamber enclosing the gradient coils of the MR system (figures 1, 2; columns 7 and 8, lines 46-67 and 11-32).

It would have been obvious to one of ordinary skill in the art to combine Takamori et al's vacuum chamber with the cooling system of Nerreter to maintain stable temperature of gradient coils and the MR system to improving image quality.

As regards to claim 13, Nerreter further teaches coolant flow control valve to control and adjust coolant flow to the cooling system (figure 1, numerals 10-12).

As regards to claim 14, Nerreter teaches a temperature sensor (figure 1, numeral 7), but fails to teach a plurality of temperature sensors. It would have been obvious to one of ordinary skill in the art to have a plurality of temperature sensors in thermal contact of specific places of the MR device to further improve temperature control, improving image quality.

As regards to claims 15 and 16, Nerreter further teaches feedback loop to control gradient coil temperature and maintain it at a constant level (figure 1, numeral 12).

As regards to claim 21, Nerreter teaches a cooling method using cooling tubes of a cooling system, which pass through a heat exchanger to cool an MRI system and its gradient coils (figure 1, numerals 1 and 6; see abstract). Further, Nerreter teaches monitoring and adjusting gradient coil temperature of the MRI system (see abstract, column 1, lines 5-25). Nerreter does not teach a sealed enclosure with removed moisture to house the gradient coils. Takamori et al teach a sealed enclosure to house gradient coils with an attached vacuum pump to remove moisture (figure 1 and 2, numeral 56; columns 1 and 2, lines 45-67 and 11-32). It would have been obvious to one of ordinary skill in the art to adapt Takamori et al's enclosure to house the gradient coils of MRI system of Nerreter and to re-circulate coolant through cooling tubes in the

sealed enclosure and through the heat exchanger to control temperature of gradient coils, and of MRI system to improve image quality.

As regards to claim 22, Nerreter teaches gradient coil temperature feedback in real-time (figure 1-4, numeral 12) to lower the gradient temperature below an ambient dew point, if necessary, to allow higher power levels to the gradient coils.

As regards to claim 24, Nerreter further does not teach an enclosure for gradient coils and to remove moisture by creating vacuum in the enclosure. Takamori et al teach an enclosure for gradient coils and to remove moisture to create vacuum in the enclosure (figure 1 and 2, numeral 56; columns 7 and 8, lines 45-67 and 12-32). It would have been obvious to one of ordinary skill in the art to adapt Takamori et al's enclosure for gradient coils with the cooling system of Nerreter to create vacuum and remove moisture around the gradient coils in the MRI system to improve cooling of the system, which will improve image quality.

As regards to claim 28, Nerreter teaches means for heat transfer, using a coolant flowing in a cooling system of a gradient coil, and means to receive the transferred heat (figure 1, numerals 1, 4, and 6). Further, Nerreter teaches a control means for receiving feedback indicative of the operating conditions of the electrical coil (gradient coil) to dynamically adjust coolant temperature (figure 1, numerals 7-12). Nerreter does not teach an enclosure with means to transfer heat to bring internal dew point (relative humidity) below the surrounding atmosphere. Takamori et al teach an enclosure with means to transfer heat to bring internal dew point below the surrounding atmosphere (figure 1 and 2, numeral 56; columns 7 and 8, lines 45-67 and 12-32).

It would have been obvious to one of ordinary skill in the art to combine means of Takamori et al with the invention of Nerreter to create an improved cooling system for MRI and its gradient coil to improve image quality

2. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nerreter (US 6,525,537) in view of Takamori et al (US 6,043,653), and further in view of Burson (US 6,101,827).

As regards to claim 9, neither Nerreter nor Takamori et al further teach a sound alarm in the cooling system. Burson Teaches a sound alarm system useful in a heating and cooling system (see abstract; column 1, lines 16-21). It would have been obvious to one of ordinary skill in the art to incorporate sound alarm system of Burson in the cooling system of Nerreter in combination with the invention of Takamori et al as a safety system to avoid over heating of the electrical coil (gradient coil).

3. Claim 4-7, 11, 12, 17-20, 23, 25-27, 29, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nerreter (US 6,525,537) in view of Takamori et al (US 6,043,653), and further in view of Harpster (US 5,485,754).

As regards to claim 17, Nerreter teaches an MRI device with a temperature sensor to sense the temperature of a gradient coil, a coolant tube in thermal contact with the gradient coil, and a heat exchanger connected to the coolant tubes to remove heat from the coolant (figure 1, 2, 4, 7 and 6; columns 3 and 4, lines 35-55). Nerreter does not teach a vacuum chamber enclosing the coolant tubes, and a vacuum pump connected to the vacuum chamber. Takamori et al teach a vacuum chamber enclosing the coolant tubes, and a vacuum pump connected to the vacuum chamber (figures 1

and 2, numerals CS and 56; columns 7, lines 45-67). Further, neither Nerreter nor Takamori specifically teach a pressure sensor in the vacuum chamber. Harpster teaches a pressure sensor system (figure 2, numeral 48).

It would have been obvious to one of ordinary skill in the art to combine Takamori's vacuum chamber and vacuum pump with the MR cooling system of Nerreter, and further combine the pressure sensor system of Harpster with cooling system, the vacuum chamber, and the vacuum pump connected to the vacuum chamber of Nerreter and Takamori et al to establish communication between the vacuum pump, the temperature sensor, and the control system to maintain steady gradient coil temperature in and around the vacuum chamber for improved image quality.

As regards to claim 18, Nerreter further teaches coolant supply and return lines connected to the heat exchanger (figure 1, numeral 1). Nerreter does not teach a humidity sensor, vacuum chamber power supply to the gradient coil. Takamori et al teach a vacuum chamber and power supply to power gradient coil (figure 2, column 7 and 7, lines 45-67 and 1-11), and Harpster teaches a humidity sensor (figure 1, numeral 44). It would have been obvious to one of ordinary skill in the art to combine vacuum chamber and power supply line of Takamori et al and the humidity sensor of Harpster with the MR system and cooling device of Nerreter to limit the power supply to the gradient coils, depending on the basis of dew point in the vacuum chamber to avoid over heating and damage to the MR imaging device.

As regards to claim 19, Nerreter teaches a temperature sensor (figure 1, numera l7), but fails to teach a plurality of temperature sensors. It would have been obvious to one of ordinary skill in the art to have a plurality of temperature sensors at various appropriate places of the MR system to control temperature of the system more evenly.

As regards to claim 20, Nerreter teaches coolant control valve to adjust flow of the system.

As regards to claims 4 and 7, neither Nerreter nor Takamori et al further teach a pressure sensor and a humidity sensor. Harpster teaches a pressure sensor and a humidity sensor. It would have been obvious to one of ordinary skill in the art to combine pressure sensor and humidity sensor of Harpster with MR system of Nerreter and Takamori et al to monitor internal pressure and humidity (dew point) to control the vacuum pump and temperature of the chamber, depending on the dew point to further improve system controls to improve image quality.

As regards to claims 5 and 6, neither Nerreter nor Takamori et al further teach a humidity censor and a computer to calculate the internal dew point of the enclosure, based on the internal chamber temperature and humidity. Harpster teaches a humidity sensor and a computer to control internal dew point by adjusting coolant temperature and the surrounding humidity (figure 2, numerals 38, 42 and 44). It would have been obvious to one of ordinary skill in the art to adapt the computer control system and the humidity sensor of Harpster with the MR system of Nerreter and Takamori et al to further maintain relatively constant temperature and humidity in the system to improve image quality.

As regards to claims 11, 12, 29 and 30, neither Nerreter nor Takamori et al further teach a humidity sensor and a pressure sensor in the vacuum chamber. Harpster teaches a humidity sensor and a pressure sensor (figure 2, numerals 44, 48).

It would have been obvious to one of ordinary skill in the art to adapt the humidity sensor and the pressure sensor system of Harpster in the vacuum chamber the MR system of Nerreter and Takamori et al to control humidity and chamber pressure to run MR system and its gradient coil at an optimum condition to improve image quality.

As regards to claim 25, Takamori et al teach a MR device with a coolant control system (figures 1 and 2, columns 7 and 8, lines 45-67, and 1-65). Takamori et al do not teach a coolant control system kit adaptable to an MR device, with a humidity sensor in the resonance module, a temperature sensor in thermal contact to the MR device, and a controller connected to the temperature sensor to control coolant temperature. Harpster teaches a coolant control system apparatus (kit), which can be adapted to an MR device, having a humidity sensor in the resonance module, a temperature sensor in thermal contact with the MR device, and a controller connected to the temperature sensor to control coolant temperature (figures 1 and 2, numerals 38, 42 and 44).

It would have been obvious to one of ordinary skill in the art to adapt the coolant control system kit of Harpster with the MR device of Takamori et al to improve the cooling system at a low cost.

As regards to claim 26 and 27, Takamori does not specifically further teach temperature sensors and a humidity sensor. Harpster teaches a humidity sensor and a temperature sensor (figure 2, numerals 38, 44). Harpster fails to teach a plurality of

temperature sensor to be placed at different suitable places in a MR device to monitor temperature at more than one place. It would have been obvious to one of ordinary skill in the art to adapt Harpster's kit with plurality of temperature sensors and a humidity sensor at appropriate places in the MR device of Takamori et al to finely control the temperature and transmit the information to the control to improve image quality.

4 This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brij B Shrivastav whose telephone number is 703-305-0649. The examiner can normally be reached on 7 AM to 4 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego F. F. Gutierrez can be reached on 703-308-3875. The fax phone numbers for the organization where this application or proceeding is assigned are 703-308-7722 for regular communications and 703-304-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-305-0956.

Bbs
April 24, 2003

Brij B. Shrivastav
Patent Examiner